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TIRE VULCANIZATION METHOD AND VULCANIZATION DEVICE THEREFOR

[Taiya karyu hoho oyobi sono karyu sochi]

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Claims

1. A tire vulcanization method characterized by the following facts: after a green tire is set while it is centered with respect to a bladder, which is attached to a bladder centering mechanism that protrudes from the central part of a lower mold, while an upper and the lower molds and a split-type sector mold mechanism provided in the circumferential direction are open,

and a preliminary-pressurized fluid is introduced under said conditions so as to shape the green tire,

parts of the aforementioned sector mold mechanism are clamped and fixed together while lowering the aforementioned upper mold after the bladder centering mechanism is lowered to set the green tire on the lower mold,

a heated pressurized fluid is introduced into the aforementioned bladder under said conditions,

the sector parts are heated using a heating means embedded in the aforementioned sector mold mechanism so as to vulcanize the green tire,

the heated pressurized fluid inside of the aforementioned bladder is discharged after the vulcanization is completed,

the upper mold is raised, and the vulcanized finished tire is taken out of the aforementioned respective molds and the bladder centering mechanism.

2. A tire vulcanization device characterized by the following facts:

a lower base plate and an upper base plate are fixed at a prescribed distance from each other via multiple support rods;

a bladder centering mechanism equipped with a bladder is provided on the aforementioned lower base plate;

a lower mold equipped with a heating means is provided in a detachable fashion around said bladder centering mechanism;

a heating means is provided around the lower mold;

a split-type sector mold is provided in such a manner that it can be extended, contracted, and moved radially toward the aforementioned bladder centering mechanism;

a support plate, which is raised and lowered using a hoist cylinder, is provided over the support rods which are provided between the aforementioned lower base plate and the upper base plate;

a clamp-fixing means, which is used for mold clamping at the time of vulcanization, is provided between the aforementioned lower base plate and the support plate; and

an upper mold, which is equipped with a heating means via a side plate, and guide means, which extend, contract, and move the aforementioned split-type sector mold as the support plate is raised and lowered, are provided on the lower surface of the aforementioned support plate.

3. The tire vulcanization device described in Claim 2, characterized in that a pressurized fluid introduction device, which is used to introduce a pressurized fluid into the bladder, is connected to the aforementioned bladder centering mechanism.

4. The tire vulcanization device described in Claim 2 or 3, characterized in that the aforementioned split-type sector mold is configured using multiple separated slide blocks that allow sector parts having respective tire profile surfaces to be non-permanently attached, and said slide blocks are installed in such a manner that they can be slid along guide rails that are installed on the lower base plate.

5. The tire vulcanization device described in Claim 2, 3, or 4, characterized in that the aforementioned slide blocks are configured such that a fan-shaped inclined surface is formed on each of the back surface side; and tapered blocks of the guide means, which are hooked to the aforementioned support plate, engage with said inclined surfaces.

6. The tire vulcanization device described in Claim 2, 3, 4, or 5, characterized in that it is provided with stopper means which lock the tapered blocks engaged with the aforementioned slide blocks from the back surface side during the mold clamping at the time of the aforementioned vulcanization.

7. The tire vulcanization device described in Claim 2, 3, 4, 5, or 6, characterized in that a sealing means, which hermetically covers the aforementioned respective molds at the time of vulcanization, is provided on the lower surface of the aforementioned support plate.

Detailed description of the invention

[0001]

Technical field of the invention

The present invention pertains to a tire vulcanization method and a tire vulcanization device. More specifically, it pertains to a tire vulcanization method and tire vulcanization device which save space due to the use of a compact configuration while improving tire uniformity and productivity.

[0002]

Prior art

In the case of a conventional tire vulcanization machine utilizing a sectional container, as shown in Figure 7, for example, an unvulcanized tire W is set on centering mechanism 2 (bladder device, for example) of the vulcanization machine when respective sector molds 1 which are divided in the circumferential direction are open.

[0003]

Then, the main body of the vulcanization machine is operated via hoisting/pressurization means 3, such as a driving motor and a hydraulic cylinder, so as to lower upper mold 5, which is attached to inner top plate 4, in order to press side surface Wa of unvulcanized tire W against lower mold 6 which is attached to base plate 6a.

[0004]

In addition, respective sector molds 1 are moved in the horizontal direction via a sectional container, which is configured with outer ring 8 attached to top plate 7 of the vulcanization machine and segment 9, so as to press them against tread part Wb of unvulcanized tire W. A heated compressed fluid Q, such as a vapor, is introduced into unvulcanized tire W via bladder 10, which constitutes centering mechanism 2 under said conditions, for vulcanization while an internal pressure is applied to tire W.

[0005]

In other words, the conventional vulcanization method is configured such that upper mold 5 is moved vertically while the movements of respective sector molds 1 are converted into the horizontal direction via outer ring 8 and segment 9 which are equipped with the same conically curved surfaces (tapered surfaces); and the force generated as the main body of the vulcanization machine is lowered in the perpendicular direction is used as a force to clamp the molds and as a force to retain the internal pressure at the same time.

[0006]

Here, 3a represents a cylinder, which is used to remove respective sector molds 1 from tire W after vulcanization and prevents respective sector molds 1 and segment 9 from being raised when outer ring 8 is raised.

[0007]

Problem to be solved by the invention

However, because all conventional vulcanization devices of the aforementioned type had complicated structures, they required a large amount of space. In addition, because they were configured such that the respective sector molds were raised/lowered together with the upper mold and moved in the horizontal direction, they were subject to problems in terms of airtightness at the part where the molds were connected and overload applied in the circumferential direction. Also they had the problem that because 1 vulcanization machine was used to set the tire as well as to carry out the vulcanization work, it was difficult to improve tire uniformity and tire productivity.

[0008]

The purpose of the present invention is to present a new tire vulcanization method and a tire vulcanization device which save an unprecedented amount of space more than ever due to the use of a compact configuration while improving tire uniformity and productivity.

[0009]

Means to solve the problem

The tire vulcanization method of the present invention for realizing the aforementioned purpose can be summarized as follows: after a green tire is set while it is centered with respect to a bladder, that is attached to a bladder centering mechanism that protrudes from the central part of a lower mold, while an upper and the lower molds and a split-type sector mold mechanism provided in the circumferential direction are open, and a preliminary-pressurized fluid is introduced under said conditions so as to shape the green tire, parts of the aforementioned sector mold mechanism are clamped and fixed together while lowering the aforementioned upper mold after the bladder centering mechanism is lowered to set the green tire on the lower mold, a heated pressurized fluid is introduced into the aforementioned bladder under said conditions, the sector parts are heated using a heating means embedded in the aforementioned sector mold mechanism so as to vulcanize the green tire, the heated pressurized fluid inside of the aforementioned bladder is discharged after vulcanization is completed, the upper mold is raised, and the finished vulcanized tire is taken out of the aforementioned respective molds and the bladder centering mechanism.

[0010]

As described above, because the vulcanization device is small and compact, not only can the green tire be carried in easily, and the tire after the vulcanization be taken out easily, but also the vulcanization time can be reduced, so that tire uniformity and productivity can be significantly improved.

[0011]

In addition, the vulcanization device of the present invention can be summarized as follows: a lower base plate and an upper base plate are fixed at a prescribed distance from each other via multiple support rods; a bladder centering mechanism equipped with a bladder is provided on the aforementioned lower base plate; a lower mold equipped with a heating means is provided in a detachable fashion around said bladder centering mechanism; a heating means is provided around the lower mold; a split-type sector mold is provided in such a manner that it can be extended, contracted, and moved radially toward the aforementioned bladder centering mechanism; a support plate, which is raised and lowered using a hoist cylinder, is provided over the support rods that are provided between the aforementioned lower base plate and the upper base plate; a clamp-fixing means, which is used for mold clamping at the time of vulcanization, is provided between the aforementioned lower base plate and the support plate; and an upper mold, which is equipped with a heating means via a side plate, and guide means, which extend, contract, and move the aforementioned split-type sector mold as the support plate is raised and lowered, are provided on the lower surface of the aforementioned support plate.

[0012]

The present invention can also be summarized as follows: a pressurized fluid introduction device, which is used to introduce a pressurized fluid into the bladder, is connected to the aforementioned bladder centering mechanism; and the aforementioned split-type sector mold is configured using multiple separated slide blocks which allow sector pieces having respective tire profile surfaces to be non-permanently attached, and said slide blocks are provided such that they can be slid along guide rails that are installed on the lower base plate.

[0013]

Furthermore, the aforementioned slide blocks are configured such that a fan-shaped inclined surface is formed on each of the back surface sides; and tapered blocks of the guide means, which are hooked to the aforementioned support plate, engage with said inclined surfaces.

[0014]

In addition, the present invention is provided with stopper means which lock the tapered blocks engaged with the aforementioned slide blocks from the back surface side during the mold clamping at the time of the aforementioned vulcanization.

[0015]

Since the tire vulcanization device is structured in said manner, its configuration becomes simpler and more compact than those of the conventional vulcanization devices, so that it can be installed in a small space to carry out vulcanization. Thus, the vulcanization device can be manufactured inexpensively.

[0016]

Embodiment of the invention

An embodiment of the present invention will be explained below based on the attached figures.

[0017]

Figure 1 is a front view of a vulcanization device which is used to implement the tire vulcanization method of the present invention, Figure 2 is a plan view along line A-A indicated by the arrows in

Figure 1, Figure 3 is a plan view along line B-B indicated by the arrows in Figure 1, and Figure 4 is a plan view along line C-C indicated by the arrows in Figure 1. Aforementioned vulcanization device 11 is installed on the level on foundation G by its lower base plate 13 via support member 12.

[0018]

Multiple (4 at the 4 corners in the present embodiment) support rods 14 of prescribed length are provided upright on lower base plate 13, and upper base plate 15 with the same shape is provided horizontally at a prescribed distance from lower base plate 13 on said support rods 14.

[0019]

As shown in Figure 2, liftable bladder centering mechanism 17 equipped with bladder 16 is provided at the center part of aforementioned lower base plate 13; and lower base mold 18 having such heating means 18a as a rod heater around it is detachably provided while said bladder centering mechanism 17 is placed at the center. Furthermore, split-type sector mold 20 (sector mold mechanism), which is equipped with heating means 19 as a rod heater and can be extended, contracted, and moved radially toward aforementioned bladder centering mechanism 17, is provided around lower mold 18.

[0020]

As shown in Figure 3, support plate 23, which is raised and lowered using hoist cylinder 21 provided on upper base plate 15 and multiple (although 2 units are used in the present embodiment, no particular restrictions are imposed on the number), is attached horizontally to support rods 14 which are provided between aforementioned lower base plate 13 and upper base plate 15; upper mold 25 equipped with such heating means 25a as a rod heater is attached to the lower surface of said support plate 23 in a hoistable

fashion via side plate 24; and guide means 26, which extend, contract, and move aforementioned split-type sector mold 20, is attached to its circumference.

[0021]

Aforementioned split-type sector mold 20 is configured with multiple divided slide blocks 28, which allow sector pieces 27 having respective tire profile surfaces to be non-permanently attached; aforementioned heating means 19, such as a rod heater, is embedded in said slide blocks 28; and they are installed in such a manner that they can be slid along linear guide rails 29 which are installed on lower base plate 13.

[0022]

As shown in Figure 4, aforementioned slide blocks 28 are configured such that they each has fan-shaped inclined surface 28a that is formed on the back surface side at prescribed angle of inclination α (for example, 15-20°, or preferably, around 18°), whereby engagement part 30a of tapered block 30 of guide means 26, which is hooked to aforementioned support plate 23, engages with said inclined surface 28a in order to extend, contract, and move the respective parts of split-type sector mold 20 toward bladder centering mechanism 17.

[0023]

That is, engagement groove 28x has a prescribed angle of inclination α that is formed on inclined surface 28a formed on the back surface of slide block 28, whereby engagement part 30a of tapered block 30 engages with said engagement groove 28x. Thus, engagement groove 28x of guide block 28 and engagement part 30a of tapered block 30 are fitted together as tapered block 30 of guide means 26,

which can be raised/lowered are raised, and split-type sector mold 20 is thereby extended/contracted with respect to bladder centering mechanism 17.

[0024]

That is, when tapered block 30 is lowered, while engagement part 30a of tapered block 30 is engaged with engagement groove 28x of slide block 28, the force applied in the perpendicular direction is converted into horizontal force components via the tapered surface in order to move sector mold 20 toward bladder centering mechanism 17. In addition, when tapered block 30 is raised, sector mold 20 is moved away from bladder centering mechanism 17 due to a friction force generated between engagement part 29 of tapered block 30 and engagement groove 28x of slide block 28.

[0025]

In addition, as described above, when angle of inclination α of tilted surface on the back inclined surface side 28a of slide block 28 is set to 15-20°, or preferably, around 18°, and upper corner part 28R of engagement groove 28x of slide block 28 to be engaged with engagement part 29 is machined to have a radius of 10-30 mm, a mechanism that allows both members to engage with each other smoothly without any shock with respective part of sector mold 20 to open/close automatically as tapered blocks 30 are raised/lowered.

[0026]

Here, it is desirable to design the angle of inclination of tilted surface 28a of slide block 28 to be 20° or less. If it is 25° or greater, the load is increased so much that deformation of tapered lock 30 may result.

[0027]

As for aforementioned bladder centering mechanism 17, the top part of bladder 16 formed into a tubular shape using the aforementioned flexible material is fixed to the top end of center post 32 which is raised/lowered via bladder hoist cylinder 31 via clamp means 33, and the bottom part of bladder 16 is fixed to bladder clamp means 34 that is provided inside lower mold 18. Supply/discharge pipe 35, which is used to introduce/discharge heated pressurized fluid Q as vapor or a nitrogen gas at a prescribed temperature and pressure, is connected to the inside of bladder 16 that has been installed in said manner; and said supply/discharge pipe 35 is connected to a pressurized fluid introduction device (not shown) that is provided outside of the vulcanization device.

[0028]

Stopper means 36, such as a stopper ring, is provided on lower base plate 13 which is placed along the circumference of aforementioned slide blocks 28. Stopper member 37 with an L-shaped cross section, which is formed on the back surface side of tapered block 30 which engages with aforementioned slide block 28, comes into contact with said stopper means 36 in order to prevent the molds from opening during the mold clamping at the time of tire vulcanization.

[0029]

Furthermore, mold clamp means 37 [sic; 38], which are used to clamp the molds during the vulcanization, are provided on aforementioned upper base plate 15. Said mold clamp means 38 are used to prevent the upper molds 25 from opening during tire vulcanization. As shown in Figure 5, guide rods

22, which protrude above upper base plate 15, are locked by means of locking mechanisms 39, such as hydraulic cylinders, in order to prevent the molds from opening.

[0030]

Here, mold clamp means 38 used for clamping the molds at the time of the vulcanization are restricted to those means which lock guide rods 22 protruding above upper base plate 15 using locking mechanisms 39, and no particular restrictions are imposed on the structure as long as molds can be fitted together between lower base plate 13 and support plate 23.

[0031]

Sealing means 40, which covers the entire circumference of the molds at the time of the vulcanization, is provided on the lower surface of support plate 23. Said sealing means 40 comprises first seal plate 41, which covers the circumference of upper mold 25 when upper mold 25 is lowered, and second seal plate 42, which covers the entire circumference of the mold during the vulcanization. They are structured such that they cover the circumference of upper mold 25 before upper mold 25 is completely closed so as to remove the air from the molds while working to seal the entire circumference of the molds containing green tire W airtightly during the vulcanization once the molds are closed completely.

[0032]

Next, the method for vulcanizing tire using the aforementioned vulcanization device will be explained with reference to Figures 1 to 6.

[0033]

First, while upper mold 25, lower mold 18, and split-type sector mold 20 provided in the circumferential direction are open, green tire W (unvulcanized tire W) is set while it is centered with respect to bladder 16 that is attached to bladder centering mechanism 17 which protrudes from the central part of lower mold 18. Green tire W is automatically carried in, centered, and carried out using a transport device (not shown).

[0034]

A fluid at prescribed temperature pre-pressurized to a prescribed pressure is introduced into bladder 16 in said state so as to shape green tire W and hold green tire W. Then, bladder centering mechanism 17 is lowered in order to set green tire W onto lower mold 18.

[0035]

The parts of aforementioned sector mold 20 are put together and fixed while aforementioned upper mold 25 is lowered in said state. As described above, when tapered blocks 30 are lowered in conjunction with the lowering of support plate 23, this operation is carried out by moving sector mold 20 toward bladder centering mechanism 17 by converting the downward force applied in the perpendicular direction into horizontal force components via the tapered surfaces while engagement parts 30a of tapered blocks 30 are engaged with engagement grooves 28x of slide blocks 28 of sector mold 20.

[0036]

In addition, because first sealing plate 41 of sealing means 40 is also lowered when support plate 23 is lowered so as to hermetically cover the circumference of upper mold 25, air in and around upper mold

25 is drawn out using a vacuum device (not shown) at this time in order to eliminate the effects of residual air during vulcanization.

[0037]

Then, because second seal plate 42 of sealing means 40 covers the entire circumference of the molds when upper mold 25 and sector mold 20 are completely closed, air is drawn out of the molds in said state using the vacuum device (not shown) in order to create a vacuum. Then, the respective molds are prevented from opening during vulcanization using said stopper means 36 as a stopper ring and mold clamp means 38.

[0038]

Pressurized fluid Qa heated to a prescribed temperature is introduced into aforementioned bladder 16 from said condition using a prescribed pressured required for vulcanization; and upper and lower molds 25 and 18 and sector pieces 27 are heated using heating means 18a, 19, and 25a which are embedded in aforementioned respective molds in order to vulcanize green tire W.

[0039]

Once the vulcanization is completed after a prescribed time has elapsed, heated pressurized fluid Qa inside of aforementioned bladder 16 is discharged to the outside; upper mold 25 is raised so as to extend the parts of sector mold 20 (they are automatically extended as upper mold 25 is raised); and the finished vulcanized tire is removed from aforementioned upper mold 25, lower mold 18, and bladder centering mechanism 17 using a transport device (not shown), which concludes the process.

[0040]

Because the present invention is configured in the aforementioned manner, the vulcanization device is smaller and more compact that a vulcanization device equipped with the conventional sector molds, so that green tire W can be easily carried in, set, and removed after vulcanization. Moreover, the vulcanization time can be reduced, and tire uniformity and productivity can be significantly improved.

[0041]

In addition, because the air inside of the sector mold can be removed at the time of the mold clamping, spewless [sic; sprueless] tires can be manufactured, and the tire appearance and the quality can also be improved.

[0042]

Effect of the invention

Because the present invention is configured in the aforementioned manner, it offers the following excellent effects.

(a) It configuration is simpler than that of a vulcanization device equipped with conventional sector molds, it can be made more compact.

(b) Tire uniformity and productivity can be improved significantly.

(c) Because the overall device becomes compact, it requires an precedently smaller installation space, and energy can be conserved.

(d) Because the configuration is simple, maintenance and inspection a simple matter.

(e) Because the air from sector mold can be pumped out when setting the green tire, spewless tires can be manufactured, and the tire appearance and quality can also be improved.

Brief description of the figures

Figure 1 is a front view of a vulcanization device for which the tire vulcanization method of the present invention is implemented.

Figure 2 is a plan view along line A-A indicated by the arrows in Figure 1.

Figure 3 is a plan view along line B-B indicated by the arrows in Figure 1.

Figure 4 is a diagram for explaining the relationship between a slide block and a guide means of a split-type sector mold.

Figure 5 is a plan view along line C-C indicated by the arrows in Figure 1.

Figure 6 is a front view of the vulcanization device during tire vulcanization.

Figure 7 is a partial-cross-sectional view of a tire vulcanization device equipped with conventional sector molds.

Explanation of symbols

1	Sector mold
2	Centering mechanism of vulcanization machine
W	Unvulcanized tire
Wa	Side surface
3	Hoisting/pressurization means
4	Inner top plate
5	Upper mold
6	Lower mold
6a	Base plate

7	Top plate
8	Outer ring
9	Segment
10	Bladder
Wb	Tread part
Q	Heated pressurized fluid
G	Foundation
11	Vulcanization device
12	Support member
13	Lower base plate
14	Support rod
15	Upper base plate
16	Bladder
17	Bladder centering mechanism
18	Lower mold
18a	Heating means
19	Heating means
20	Sector mold (sector mold mechanism)
21	Hoist cylinder
22	Guide block
23	Support plate
24	Side plate
25	Upper mold

25a Heating means

26 Guide means

27 Sector piece

28 Slide block

28a Fan-shaped inclined surface

29 Guide rail

30 Tapered block

30a Engagement part

28x Engagement groove

α Angle of inclination

31 Bladder hoist cylinder

32 Center post

33 Clamp means

34 Bladder clamp means

35 Supply/discharge pipe

36 Stopper means

37 Stopper member

38 Mold clamp means

39 Locking mechanisms

40 Sealing means

41 First seal plate

42 Second seal plate

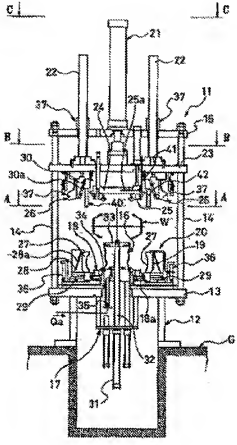

Figure 1

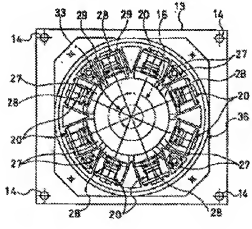

Figure 2

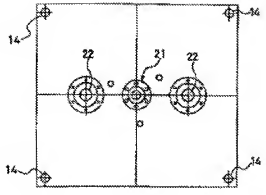

Figure 3

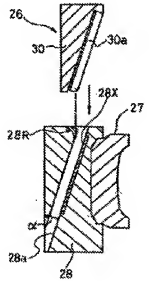

Figure 4

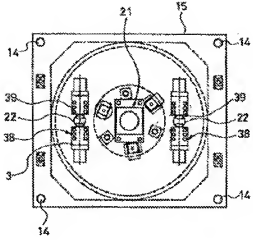

Figure 5

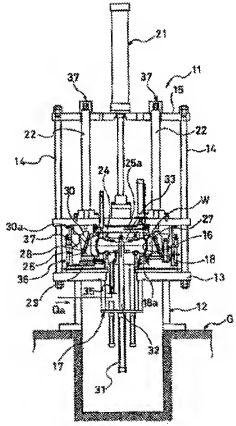

Figure 6

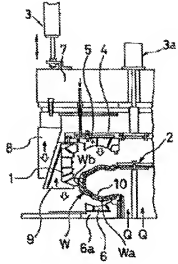

Figure 7